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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER

MONDT, JOHANNES P

ART UNIT PAPER NUMBER

2826

DATE MAILED: 05/22/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/963,933

Applicant(s)

TRAN ET AL.

Examiner

Johannes P Mondt

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-22 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-22 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on ____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) ____.
- 4) ☐ Interview Summary (PTO-413) Paper No(s) ____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

1. ***Claim 7*** recites the limitations "first layer" in line 1. There is insufficient antecedent basis for this limitation in the claim.
2. ***Claim 8*** recites the limitation "first layer" through dependency Claim 7. See above. There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. ***Claims 1-6 and 10-11*** are rejected under 35 U.S.C. 102(b) as being anticipated by Parkin (5,966,012).

Claim 1: Parkin teaches (cf. front figure, Figure 4B, title and abstract, particularly, the second sentence) a magnetic memory device comprising: a data layer 132 having a magnetization that can be oriented in first and second directions (cf. column 5, lines 60-

65), and a synthetic ferrimagnet reference layer 118 (cf. column 5, line 64), the data and reference layers having different coercivities (cf. abstract, first sentence).

Claim 2: by inherency, the data layer has a higher coercivity than the reference layer.

Claim 3: 118 includes first and second ferromagnetic layers 200 and 225 (cf. column 6, 38-43) separated by a spacer layer 210 (cf. column 6, line 40), the first and second ferromagnetic layers having different coercivities (cf. column 6, lines 61-65).

Claim 4: the spacer layer 210 is taught to be formed of Ru (i.e., ruthenium) (cf. column 9, lines 7-8), the same as all three Examples in Applicant's specification, and Ru is a electrically conducting, "magnetically non-conducting" material in the nomenclature of Applicant.

Claim 5: the coercivity of the reference layer is determined by the thickness of the first and second ferromagnetic layers (cf. column 6, line 61 – column 7, line 2).

Claim 6: the magnetic moments of the first and second ferromagnetic layers substantially cancel out (cf. column 6, line 61 – column 7, line 2).

Claim 10: the device further comprises a spacer layer 120 (cf. column 5, lines 60-65 and abstract, first sentence) between the data and reference layers.

Claim 11: said spacer layer is a tunneling barrier layer (cf. abstract, first sentence).

3. **Claims 13-16** are rejected under 35 U.S.C. 102(b) as being anticipated by Parkin (5,966,012).

Claim 13: Parkin teaches (cf. front figure, Figure 4B, title and abstract, particularly, the second sentence) a magnetic memory device, particularly a magnetoresistive device (cf. column 1, lines 13-18), the reference layer comprising: first and second ferromagnetic layers 200 and 225 having different coercivities (cf. column 6, lines 61-65); and a spacer layer 210 (cf. column 6, line 40) between the first and second ferromagnetic layers.

Claim 14: the spacer layer 210 is taught to be formed of Ru (i.e., ruthenium) (cf. column 9, lines 7-8), the same as all three Examples in Applicant's specification, and Ru is a electrically conducting, "magnetically non-conducting" material in the nomenclature of Applicant.

Claim 15: the coercivity of the reference layer is determined by the thickness of the first and second ferromagnetic layers (cf. column 6, line 61 – column 7, line 2).

Claim 16: the magnetic moments of the first and second ferromagnetic layers substantially cancel out (cf. column 6, line 61 – column 7, line 2).

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. ***Claim 9*** is rejected under 35 U.S.C. 103(a) as being unpatentable over Parkin (5,966,012) in view of Gallagher et al (5,640,343). As detailed above, claim 1 is

anticipated by Parkin. Although Parkin teaches a first conductor 104 in contact with the data layer and a second conductor 102 in contact with the reference layer, Parkin does not necessarily teach the further limitation defined by claim 9 that said first and second conductors be orthogonal. However, for the purpose for maximizing space utilization and optimizing the independent directions in which the bit- and word- line actions can be performed, the data layer 24 as taught by Gallagher et al is in contact with a first conductor 5 (cf. Figs 1A-B) and a second conductor 3 is in contact with the reference layer 18 (cf. column 3, lines 45-57 and column 4, lines 6-24), the first and second conductors being orthogonal (cf. column 3, lines 51-53).

6. **Claims 12 and 17** are rejected under 35 U.S.C. 103(a) as being unpatentable over Parkin (5,966,012), in view of Monsma et al (6,269,018).

Claim 12: Parkin anticipates claim 1 (see above) but does not necessarily teach the further limitation defined by claim 12. However, Monsma et al teach a magnetic memory device (cf. title and abstract) in which both layers are free, so as to improve the write selectivity of the individual MTJ cells in an MRAM; see for instance abstract and column 4, lines 14-62. Motivation for combining the inventions stems from the validity of the above-stated purpose for any MTJ. Combinability follows from the simplicity of the modification involved, namely: replacing the pinned layer with a free layer. Reasonable expectation of success is justified by the independence of the process of building the two stacks pertaining to layers 118 and 132 in Parkin.

Claim 17: for both layers to be free the reference layer has to be soft as well.

7. **Claims 18 and 20-22** are rejected under 35 U.S.C. 103(a) as being unpatentable over Parkin (5,966,012), in view of Monsma et al (6,269,018) and Gallagher et al (5,640,343).

Claim 18: as detailed above, Parkin, in view of Monsma et al, renders unpatentable a memory cell including a data layer and soft ferrimagnet reference layer, both being "free", i.e., both data and reference layers have magnetizations that can be switched between first and second directions during write operations as both word and bit lines are involved (cf. column 3, lines 22-24). Furthermore, the reference ("second") layer is being switchable during reading operations through passing a current through sense or access line 104. None of the above cited two references necessarily teach the further limitation that "only" the second layer be so switchable, however: evidently one is enough, and hence, for reasons of economy, two would be a waste. None of the above-cited two references necessarily teach an information storage device comprising an array of such memory cells as described above. However, an information storage device comprising an array is an obvious application of the single memory cell, as is evidenced by Gallagher et al. Gallagher et al teach an MTJ (magnetic tunneling junction) array as a non-volatile magnetic random access memory (MRAM) device (cf. title, abstract, and Figures 1A-B). Said application is obvious in view of the very purpose for which the single memory cell is designed, namely the combination of many in an array. Therefore, there is obvious motivation to combine the inventions, and reasonable

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success of doing so is ensured by the mature nature of the art of making MRAM devices.

Claim 20 (and with reference to Parkin as well as the previous discussion of claims 5, 6 and 11): the coercivity of the reference layer is determined by the thickness of the first and second ferromagnetic layers (cf. column 6, line 61 – column 7, line 2).

Claim 21: the magnetic moments of the first and second ferromagnetic layers substantially cancel out (cf. column 6, line 61 – column 7, line 2).

Claim 22: the device further comprises a spacer layer 120 (cf. column 5, lines 60-65 and abstract, first sentence) between the data and reference layers, said spacer layer being a magnetic tunneling barrier layer (cf. abstract, first sentence), and thereby a magnetic tunneling junction exists in every memory cell.

8. **Claim 19** is rejected under 35 U.S.C. 103(a) as being unpatentable over Parkin, Gallagher et al and Monsma et al as applied to claim 18 above, and further in view of Gurney et al (5,408,377). As detailed above, claim 18 is unpatentable over Parkin in view of Gallagher et al. Neither Parkin, nor Gallagher et al nor Monsma et al necessarily teach the further limitation defined by claim 19. However, non-magnetic, electrically conductive spacer layers between two ferromagnetic layers, wherein the spacer layers serve to bring about a configuration in which the GMR can be exploited, and wherein only one of the ferromagnetic layers is enabled to freely rotate, has long been practiced in the art of magnetic recording, i.e., magnetic memory devices, as evidenced by Gurney et al, who teach free 70 and pinned 77 ferromagnetic layers (cf. column 5, lines

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46 and 66, resp.) separated by a non-magnetic, electrically conducting spacer (Cu layer 65) (cf. Figure 6).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Johannes P Mondt whose telephone number is 703-306-0531. The examiner can normally be reached on 8:00 - 18:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nathan J Flynn can be reached on 703-308-6601. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-7722 for regular communications and 703-308-7724 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

JPM

May 17, 2002

NATHAN J. FLYNN
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